

# Basics of Monitoring Study Design

*Using a Virtual Watershed - Dickinson Creek*

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# Today's Plan

- Provide a basic overview of the monitoring study design process
- Use a virtual watershed (Dickinson Creek) to provide an opportunity to work through the study design process
- Provide enough information for you to go back to your watersheds and begin developing or revising your group's study design
- Follow-up available



# Dickinson Creek Water Watchers



- New watershed group formed in 2001
- Mission – Protect and restore the Dickinson Creek through citizen monitoring and action
- Volunteer-based
- Main initiative – develop a vol. monitoring program

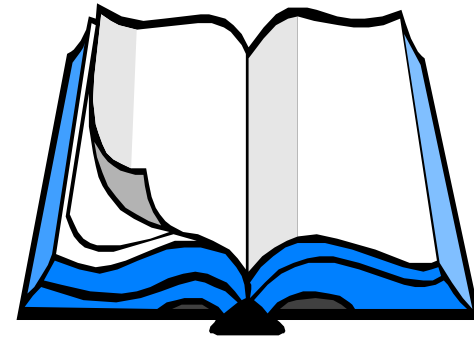


# Study Design

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A study design is a written document that describes the choices you make about monitoring:

- Why?
- What?
- Where?
- When?
- Who?
- How?



# Importance of the study design

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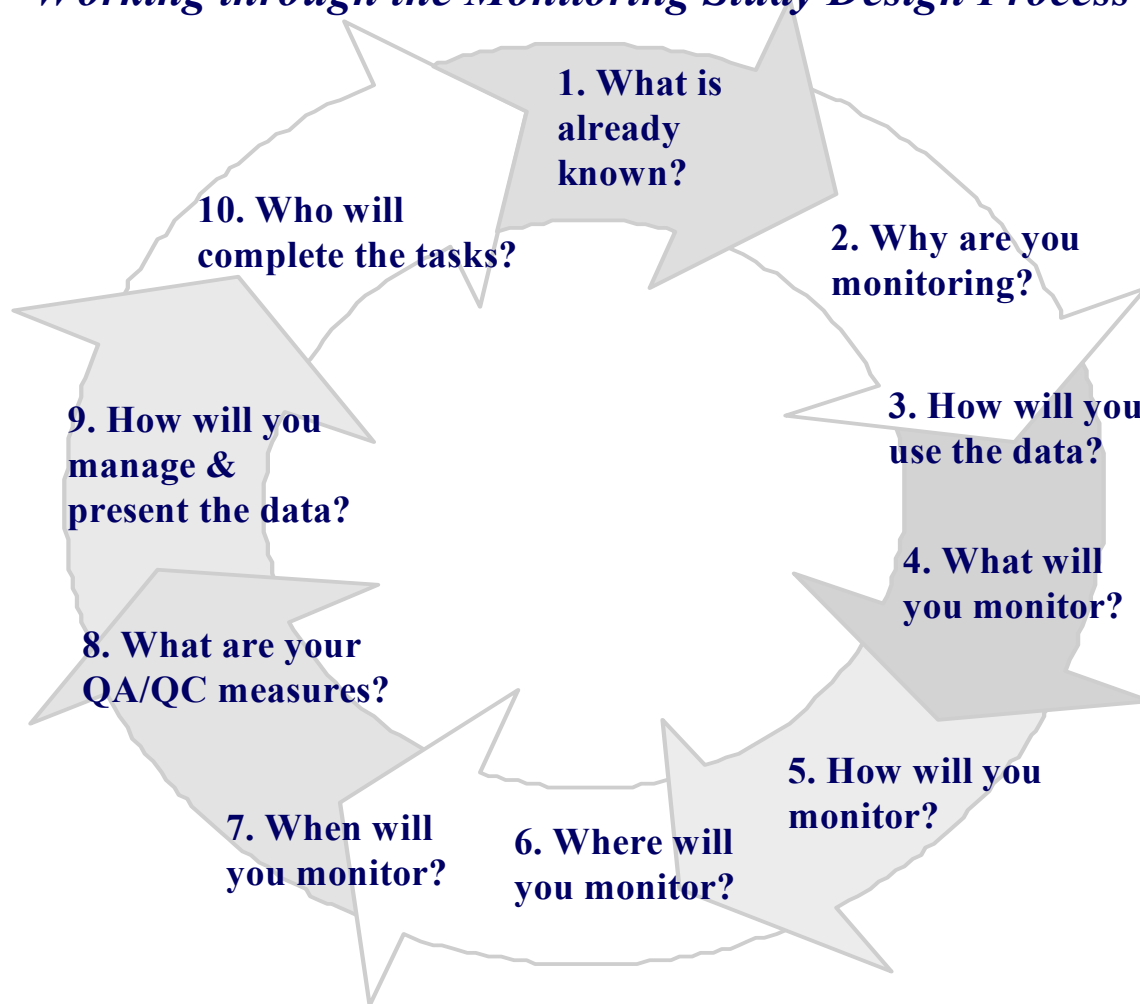
**Preparing a study design is the most important step in organizing your monitoring effort:**

- Provides focus;
- Selects appropriate monitoring strategy to address and achieve monitoring goals;
- Provides important documentation for data users; and
- Minimizes the impact of changing personnel and adds continuity



# 10-Step Process

## *Working through the Monitoring Study Design Process*





# Step 1: What Is Already Known About Your Watershed?

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## Form a Working Group

### Gather background on your watershed

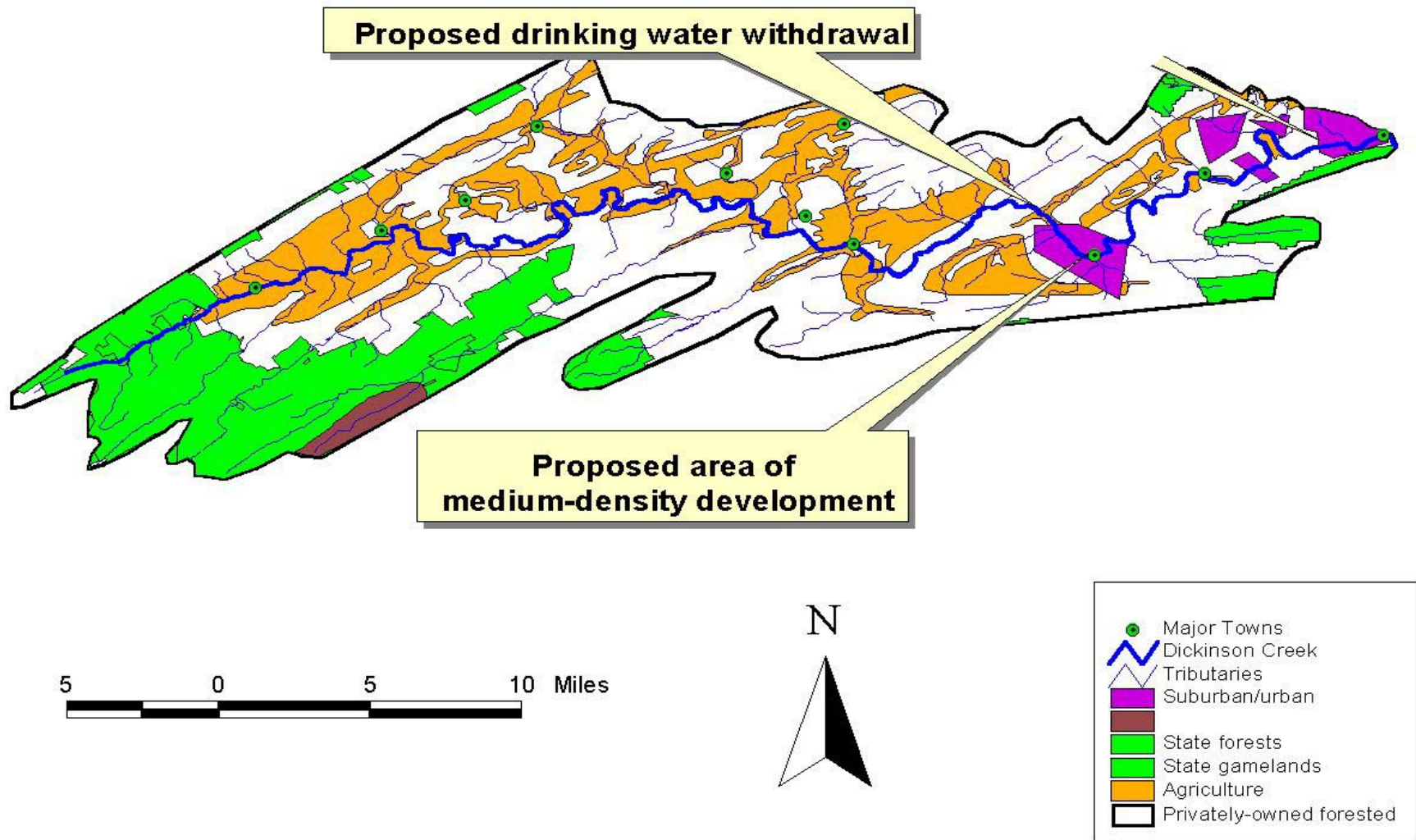
- Physical information on the watershed (watershed area, tributaries, geology, etc.)
- Land use types, communities & municipalities
- Stream Classifications (NJ 7:9B-1.15) (FW1, FW2-TP/C-1 or C-2, etc.)
- Other monitoring reports or data available – NJ WQN Stations Present
- New Jersey's Surf Your Watershed, NPDES Permits



### List known or potential issues, threats, or concerns

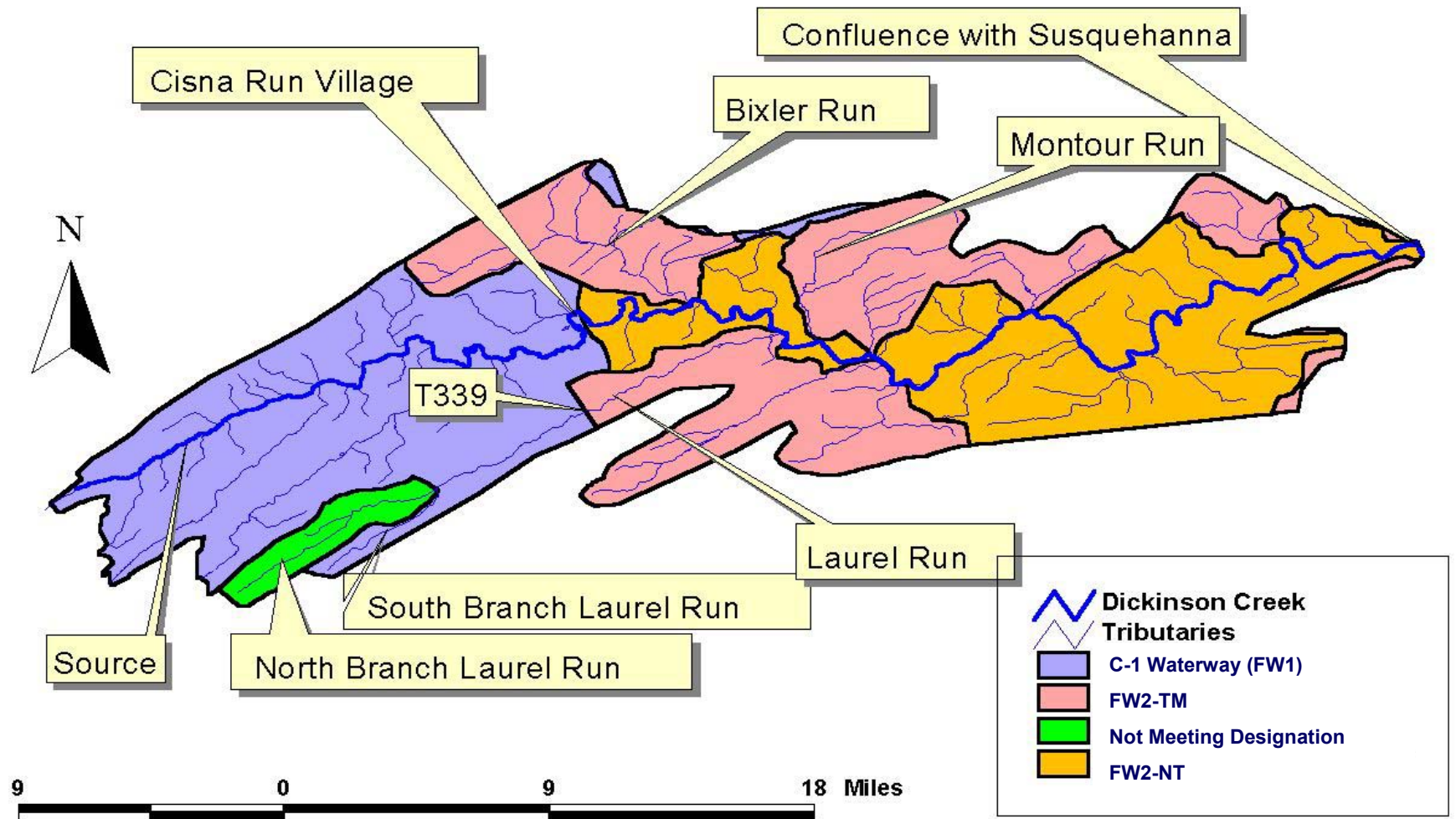


# LAND USE IN THE WATERSHED

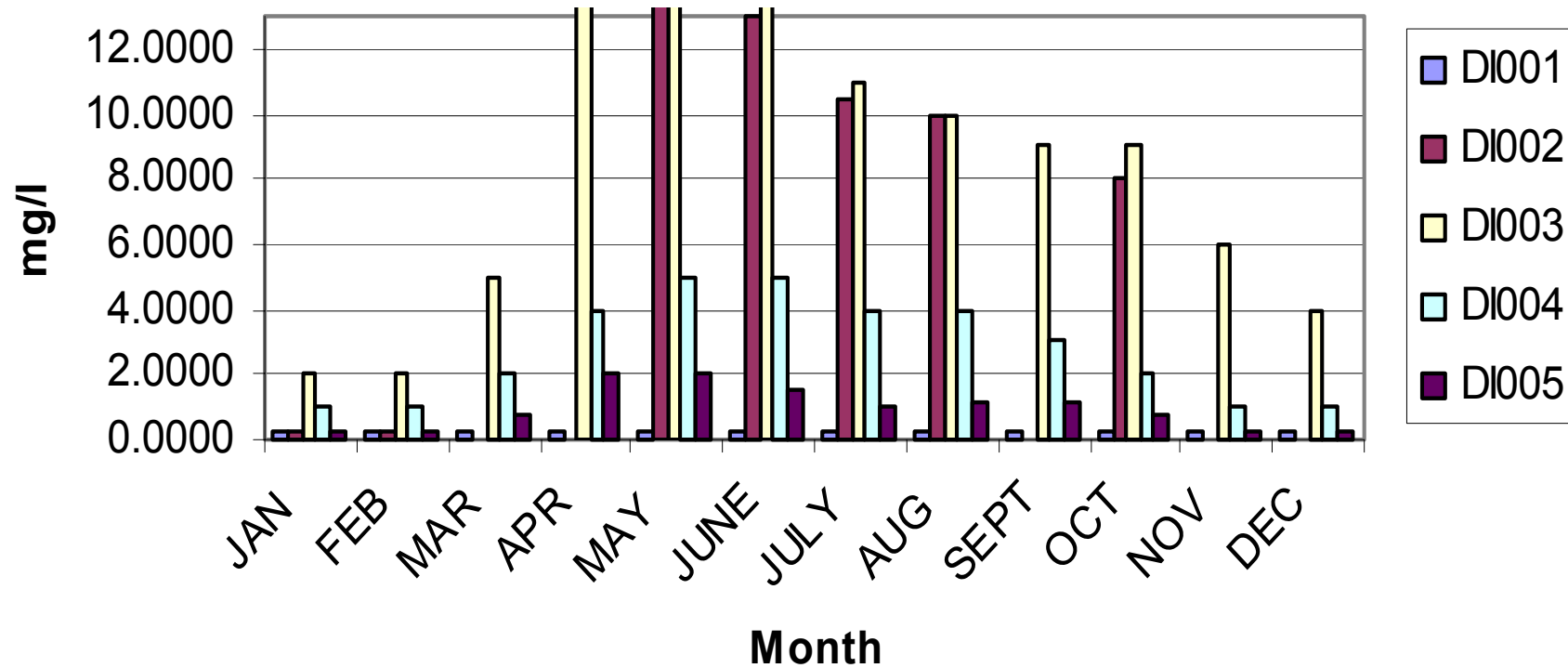




# DESIGNATED USES



# Dickinson Creek - Nitrate-Nitrogen



## Step 2: Why are you monitoring?

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Identify questions that if answered, could provide information to influence decision-makers and your group's targeted data users. Then, determine how monitoring can help answer these questions and achieve your groups' goals.

### Dickinson Creek Water Watchers



- Use monitoring program to build membership and awareness in the community.
- Collect baseline data for one year to help determine problem areas or areas with high quality.



## Step 3: Who will use the data?

**Match your monitoring purpose to your data users.**

Potential Data Users

- *Watershed group & volunteer monitors*
- *Municipalities*
- *NJ DEP for use in the 305(b) report and enforcement of 303(d) list*



### **New Jersey's Tiered Approach for Volunteer Monitoring Data:**

Purpose A: Environmental Education

Purpose B: Stewardship

Purpose C: Community Assessment

Purpose D: Indicators - State and Federal Agency Assessment





## Tier B: Stewardship

### Data User

- **Dickinson Creek Water Watchers**

### Data Use

- Gain understanding of existing conditions
- Screen for and identify problems and positive attributes
- Build membership

### Quality Needed

- Low to medium rigor
- Variety of study designs is acceptable
- QAPP desirable



# Tier C: Community and/or Watershed Level Assessment

## Quality Needed

### Data Users

- Local decision-makers
- Watershed association
- Environmental organizations
- Possibly DEP

### Data Use

- Assess current conditions
- Track trends
- Source track down of Nonpoint source pollution

- Medium level of rigor
- Data needs to reliably detect changes over time and space
- Study design is focused on pollution sources
- QAPP required

# Tier D: Indicators (visual and biological assessments, and water quality)

## Data Users

- NJDEP
- Local decision-makers
- Watershed associations
- Environmental organizations

## Data Use

- Assess current conditions and impairments
- Supplement agency data collection
- Research
- Evaluate best management practices (BMP) measures

## Quality Needed

- Medium to high level of rigor
- Study design and methods need to be equivalent and recognized by agencies using data
- Training required
- QAPP required

# Step 4: What will you monitor?

Streams are complex systems of inter-related physical, chemical, and biological characteristics.

## Watershed Indicators

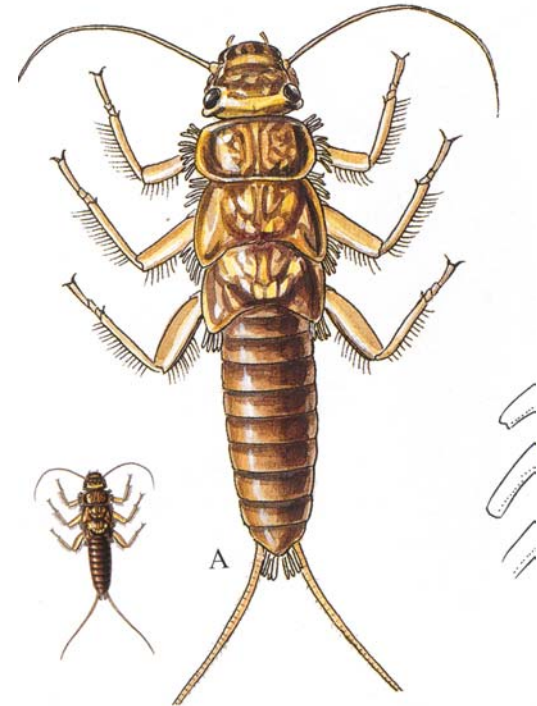
- **Biological** – fish, insects, bacteria, plants
- **Physical** – temperature, turbidity, clarity, flow, land use, stream gradient, instream cover, riparian habitat
- **Chemical** – dissolved oxygen, pH, nitrate, phosphates

## Practical Considerations

- Do you have the human & financial resources to measure it?
- How difficult is it to monitor?
- Does it help you understand a major component of the ecosystem?
- Is it understandable and explainable to the target audience?

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Common Stoneflies



# Dickinson Creek Water Watchers

## Initial Parameters

- Nitrate-nitrogen
- Dissolved oxygen
- Water temperature
- Weather & Wildlife observations





# Step 5: What sampling and analysis methods are required?

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Choose appropriate sampling methods that meet your data quality objectives and the **requirements of your data user.**

LaMotte/HACH kits (\$)

Vs.

Lab Analysis (\$\$)

Vs.

WQ Meters (\$\$\$)





# Dickinson Creek Water Watchers



## Lamotte Equipment

- Winkler titration for dissolved oxygen ( $\pm 0.2$  mg/l accuracy) (\$40)
- Cadmium reduction for nitrate ( $\pm 0.2$  mg/l accuracy) (\$75)
- Temp – ( $\pm 0.5^{\circ}\text{C}$  accuracy) (\$17)



# Step 6: Where will you monitor?

Consider safety & accessibility, potential water quality impacts, reference locations, stream designated uses.

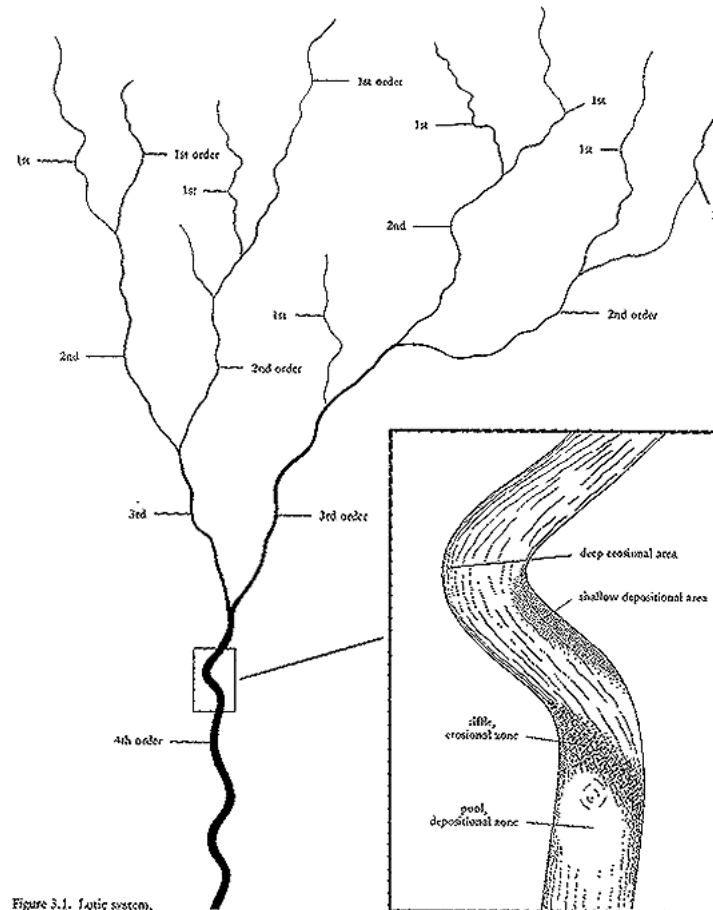


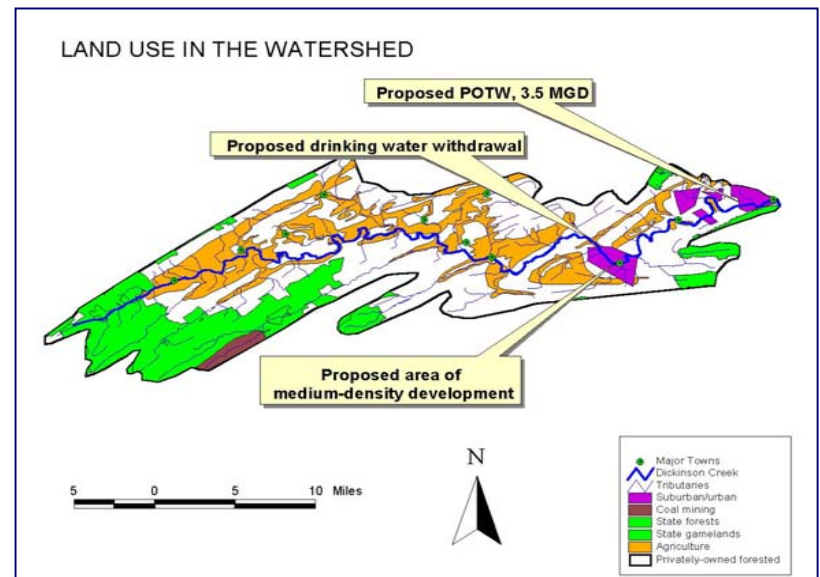
Figure 3.1. Lotic system, depicting stream orders and lotic zonation.



# Dickinson Creek Water Watchers

## Initial Sampling Stations

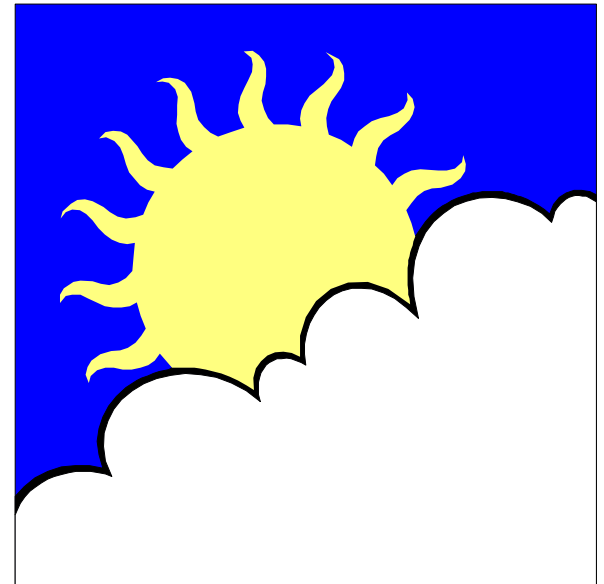
- Five Monitoring Stations
- All stations on Main Stem
- Stations spaced out from headwaters to mouth



# Step 7: When will you monitor?

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- What time of year?
- What time of day?
- Special Weather Conditions – storm events, drought, etc.
- Frequency of sampling? – consider resources and data requirements



# Dickinson Creek Water Watchers



- Monthly (last Saturday of the month)
- Not within 48 hrs of rainfall
- Collected between 10 and 1 PM





# Step 8: What are Your Quality Assurance Measures?

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**Quality control management includes most aspects of your monitoring program:**

**Organization and Planning:** Training requirements of volunteers?

**Sampling and Analysis:** How will you care for and calibrate your monitoring equipment?

**Data management:** How will you ensure that the data are properly recorded in the field and in a database?

**Documentation, documentation, documentation!** Manuals, study design, QAPP, datasheets, equipment and supplies records



# Dickinson Creek WW QA/QC Measures



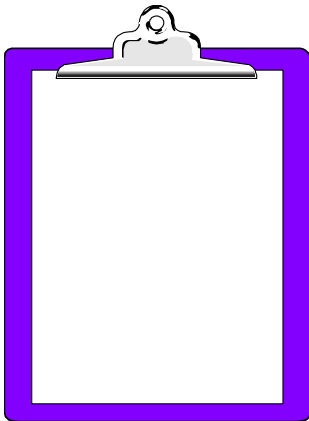
- Annual refresher courses with DRN using blind samples
- Monthly duplicates for dissolved oxygen
- Datasheets reviewed by Coordinator for accuracy
- Database with built-in QA/QC features



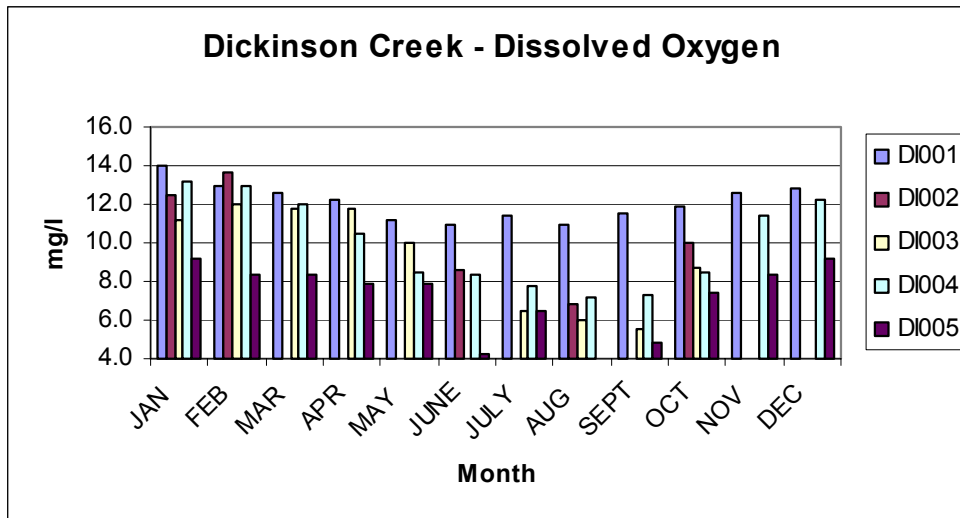
## Step 9: How is data managed and presented?

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Dealing with data involves converting raw data into useful information that sheds light on the answers to your monitoring questions.



# Dickinson Creek Water Watchers



- Excel database houses data
- Summary graphs and tables produced in Excel
- Summary graphs included in outreach materials



# Step 10: What Are the Tasks and Who Will Do Them?

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## Major Monitoring Tasks

Find a lab

Purchase equipment

Recruit and organize volunteers

Train field and lab volunteers

Monitoring

Quality assurance

Analyze your results

Report your results

Present your results

**Evaluate your study design**

**Develop written job descriptions for positions to accomplish various tasks**





# Small Group Break-Outs





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